Summary of last lecture

- Database System Structure
- Functions of DBA
- Data Model - types
  - Relational
  - Network
  - Hierarchical

Entity-Relationship(E-R) Model

- The entity-relationship (E-R) data model uses a collection of basic objects, called entities, and relationships among these objects.

- E-R Diagram is a visual representation of data, that describes how data is related to each other.

- **Entity** – An entity in an ER Model is a “thing” or “object ” in the real-world having properties called **attributes**.

E-R Model Contd…

- An **Entity set** is a set of entities of the same type that share the same properties, or attributes.

- **Attributes-** Entities are represented by means of their properties, called attributes. All attributes have values.

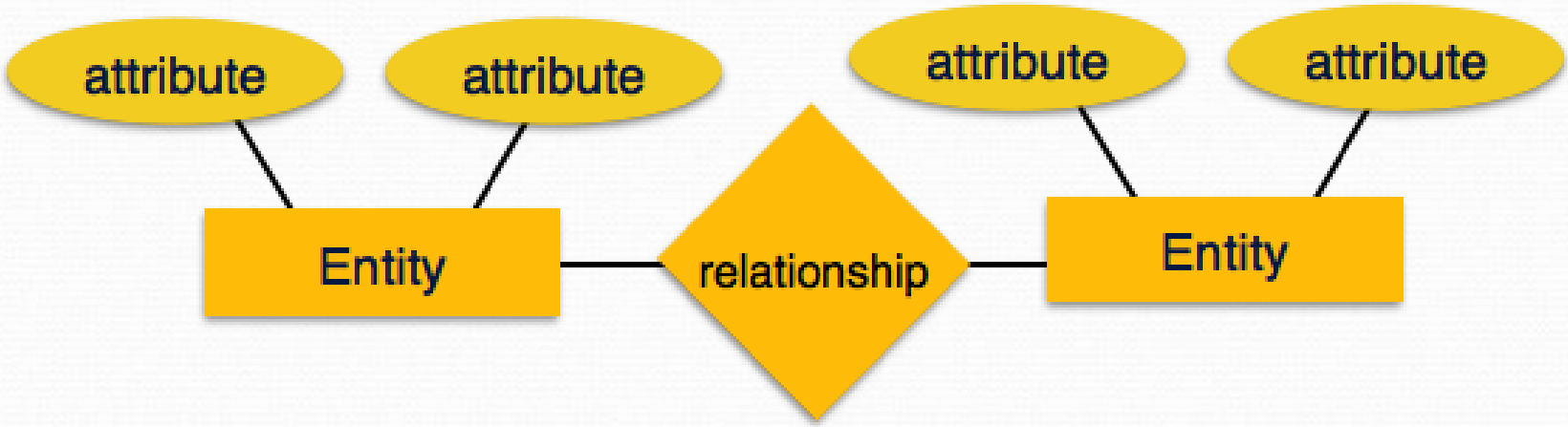
  For example, a student entity may have name, class, and age as attributes.

- Every **attribute** is defined by its set of values called **domain**.

  For example, a student's name cannot be a numeric value. It has to be alphabetic. A student's age cannot be negative, etc.

E-R Model Contd…

- E-R Model is based on −
  - **Entities** and their attributes.
  - **Relationships** among entities.



E-R Model Contd…

Types of Attributes

- Simple attribute
- Composite attribute
- Derived attribute
- Single-valued attribute
- Multivalued attribute

E-R Model Contd…

- **Simple attribute −** Simple attributes consist of atomic values, which cannot be divided further.
  - For example, a student's phone number is an atomic value of 10 digits

- **Composite attribute −** Composite attributes are made of more than one simple attribute.
  - For example, a student's complete name may have first_name and last_name.

- **Derived attribute −** Derived attributes are the attributes that do not exist in the physical database, but their values are derived from other attributes present in the database.
  - For another example, age can be derived from data_of_birth.

E-R Model Contd…

- **Single-valued attribute** − Single-valued attributes contain single value.
  - For example − Social_Security_Number.

- **Multivalued attribute** − Multivalued attributes may contain more than one values.
  - For example, a person can have more than one phone number, email_address, etc

E-R Model Contd…

- **Relationship** − The logical association among entities is called ***relationship***.

- **Relationship Set-** A set of relationships of similar type is called a relationship set. Like entities, a relationship too can have attributes. These attributes are called ***descriptive attributes***.

E-R Model Contd…

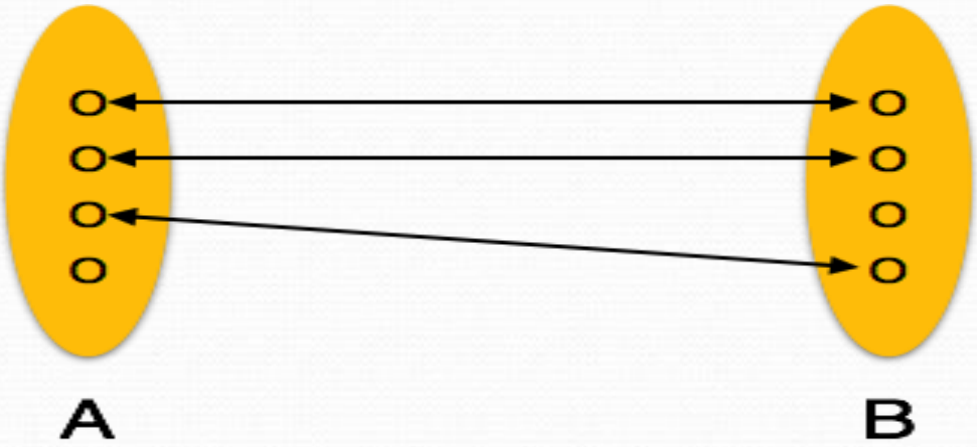
Mapping cardinalities –

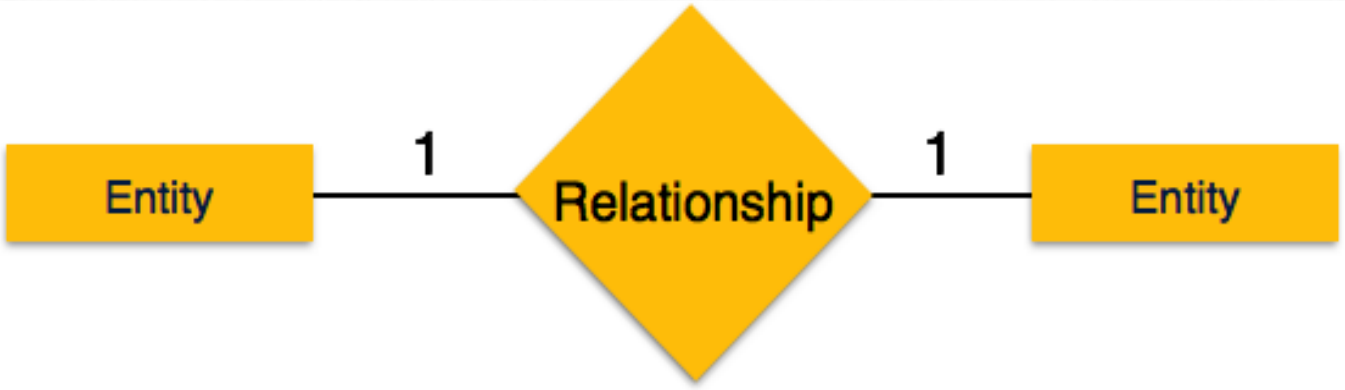
Cardinality defines the number of entities in one entity set, which can be associated with the number of entities of other set via relationship set.

- one to one
- one to many
- many to one
- many to many

E-R Model Contd…

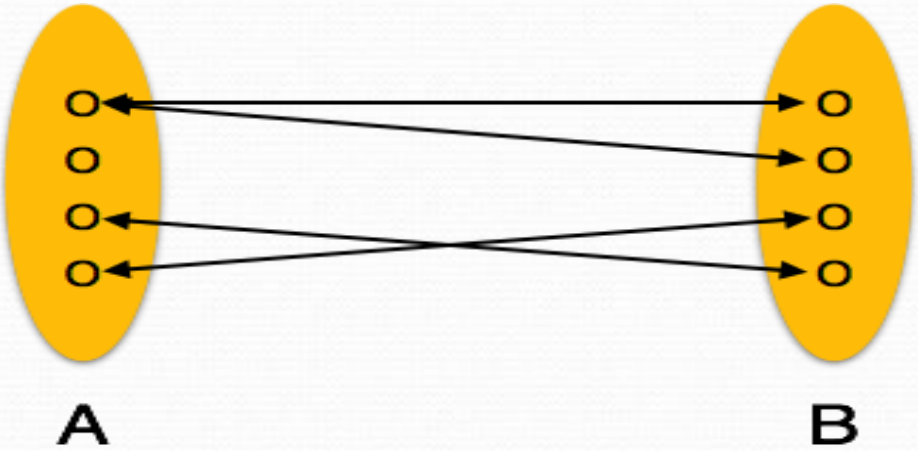
- **One-to-one -** One entity from entity set A can be associated with at most one entity of entity set B and vice versa.

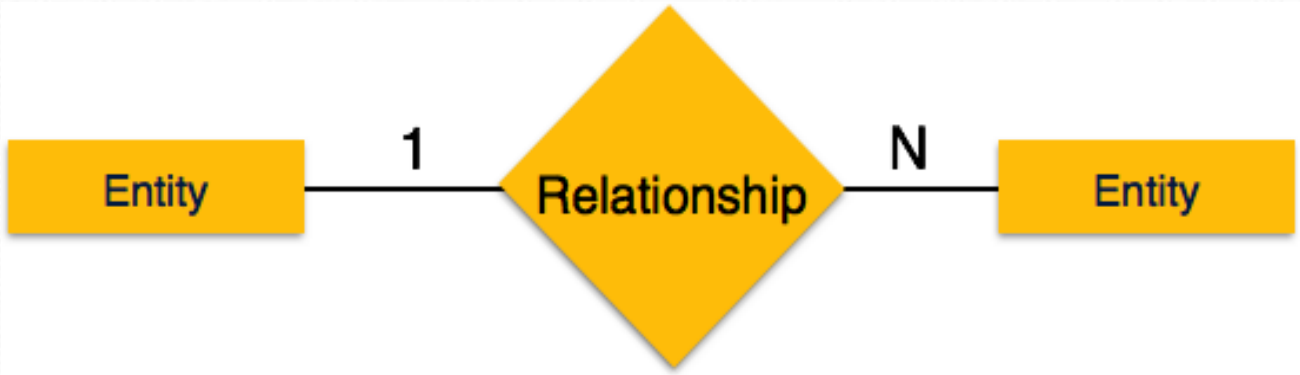




E-R Model Contd…

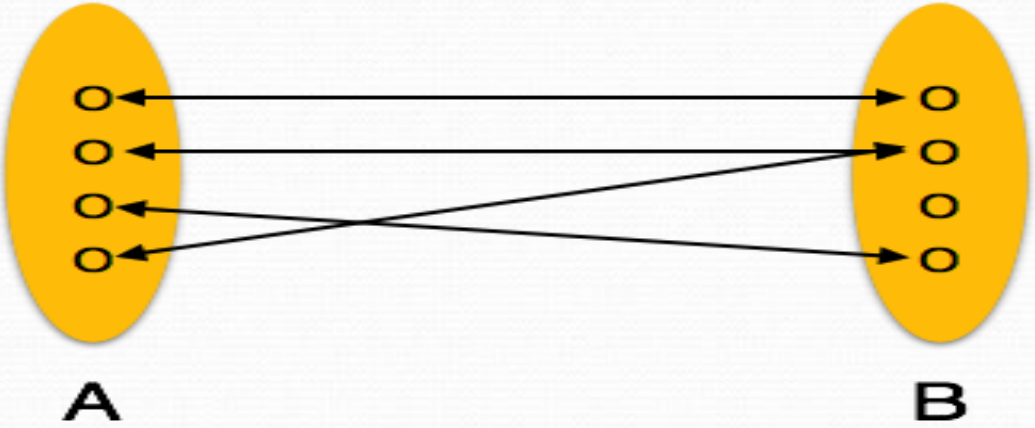
One-to-many − One entity from entity set A can be associated with more than one entities of entity set B however an entity from entity set B, can be associated with at most one entity.

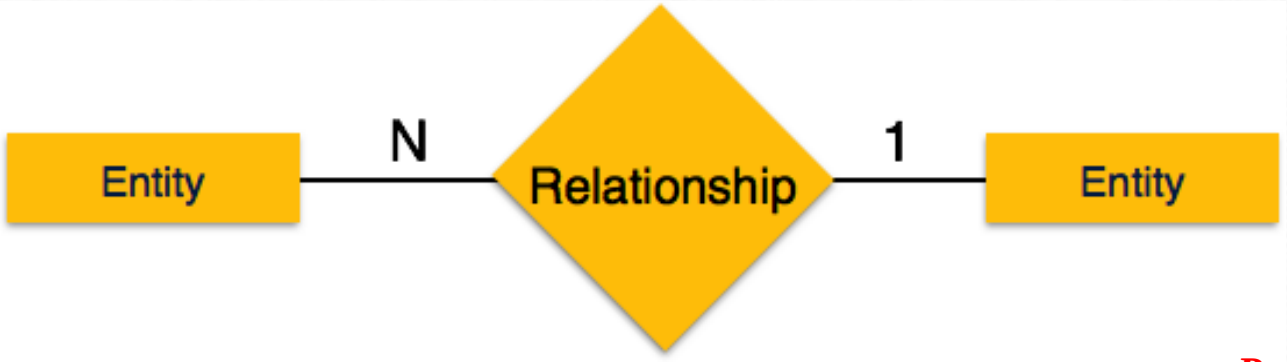




E-R Model Contd…

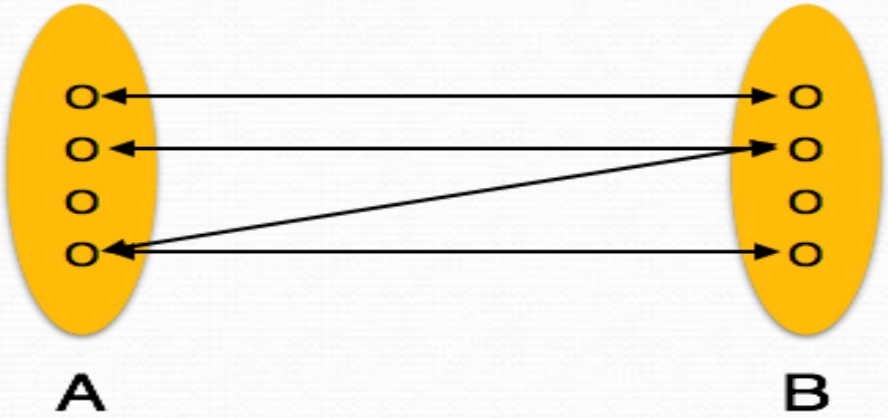
- **Many-to-one –** More than one entities from entity set A can be associated with at most one entity of entity set B, however an entity from entity set B can be associated with more than one entity from entity set A.

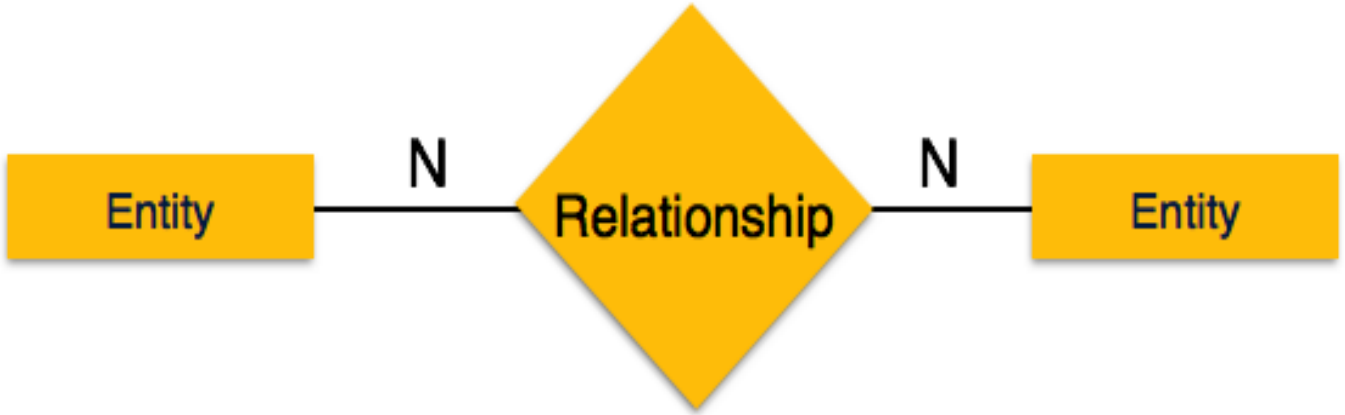




E-R Model Contd…

Many-to-many − One entity from A can be associated with more than one entity from B and vice versa.





E-R Model Contd…

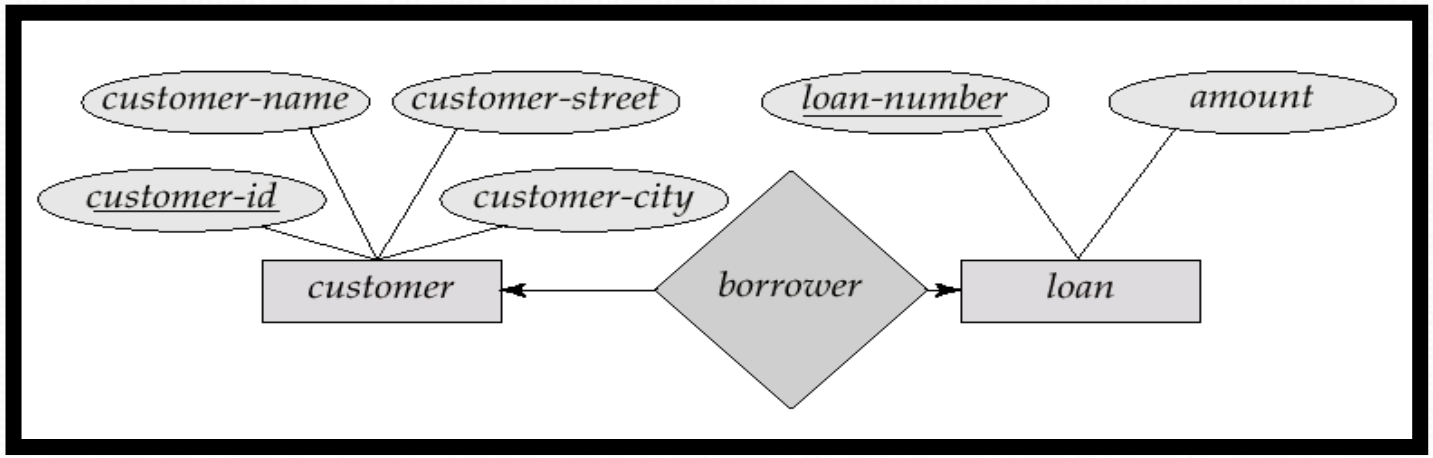
- **Cardinality Constraints**

➢ We express cardinality constraints by drawing either a directed line (→), signifying "one," or an undirected line (—), signifying "many," between the relationship set and the entity set.

➢ E.g.: **One-to-one relationship:**

✓ A customer is associated with at most one loan via the relationship borrower

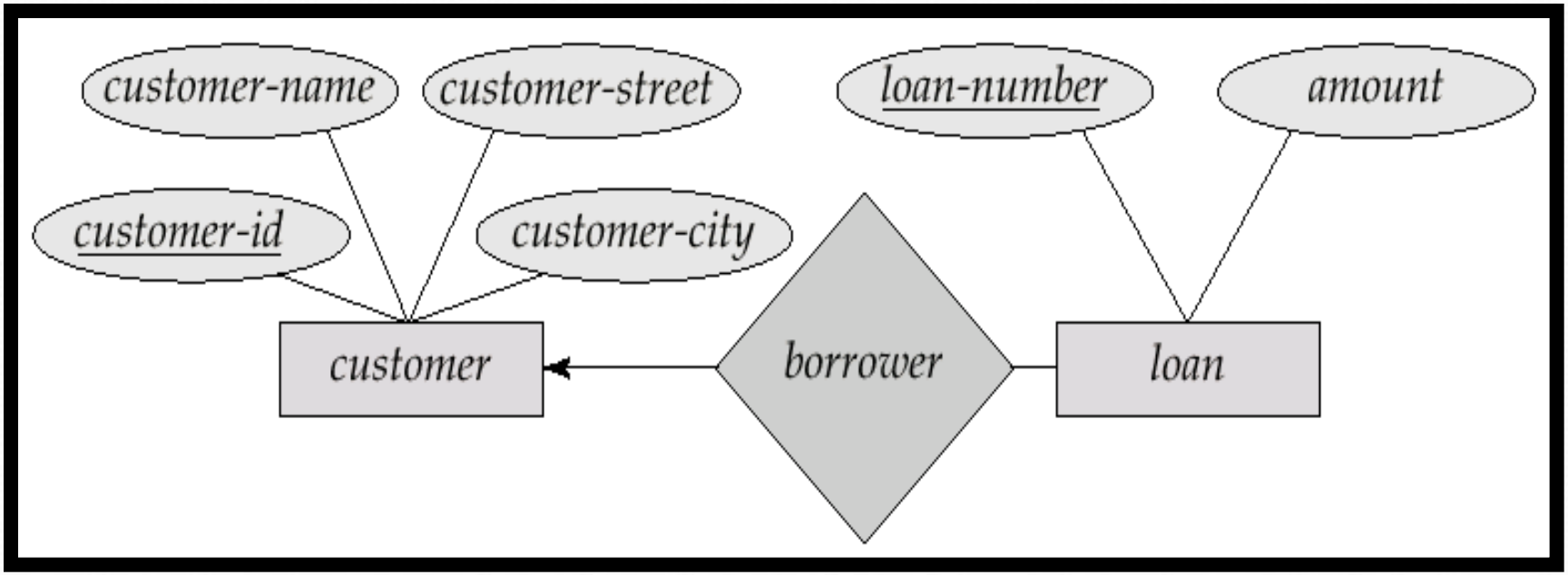
✓ A loan is associated with at most one customer via borrower



E-R Model Contd…

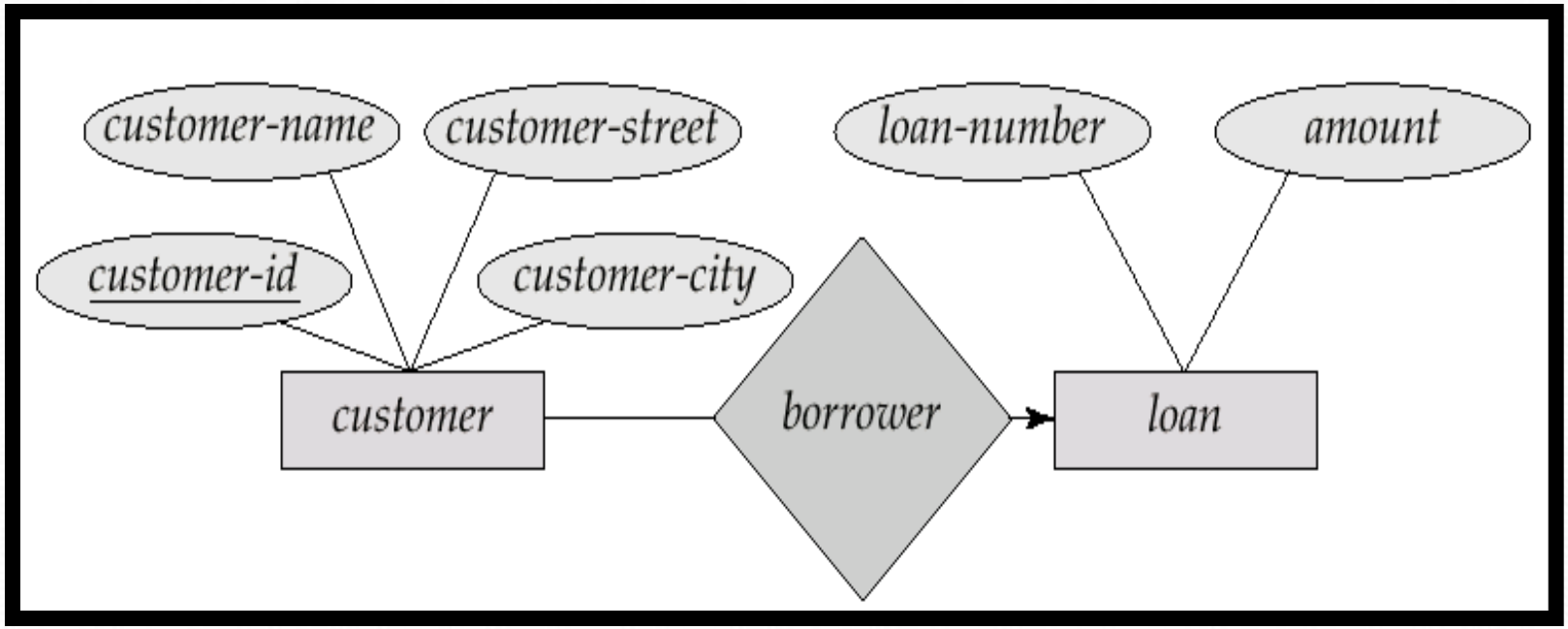
- **Cardinality Constraints**

➢ In the **one-to-many relationship** a loan is associated with at most one customer via *borrower*, a customer is associated with several (including 0) loans via *borrower*



E-R Model Contd…

- **Cardinality Constraints**
  - In a **many-to-one relationship** a loan is associated with several (including 0) customers via *borrower*, a customer is associated with at most one loan via *borrower*

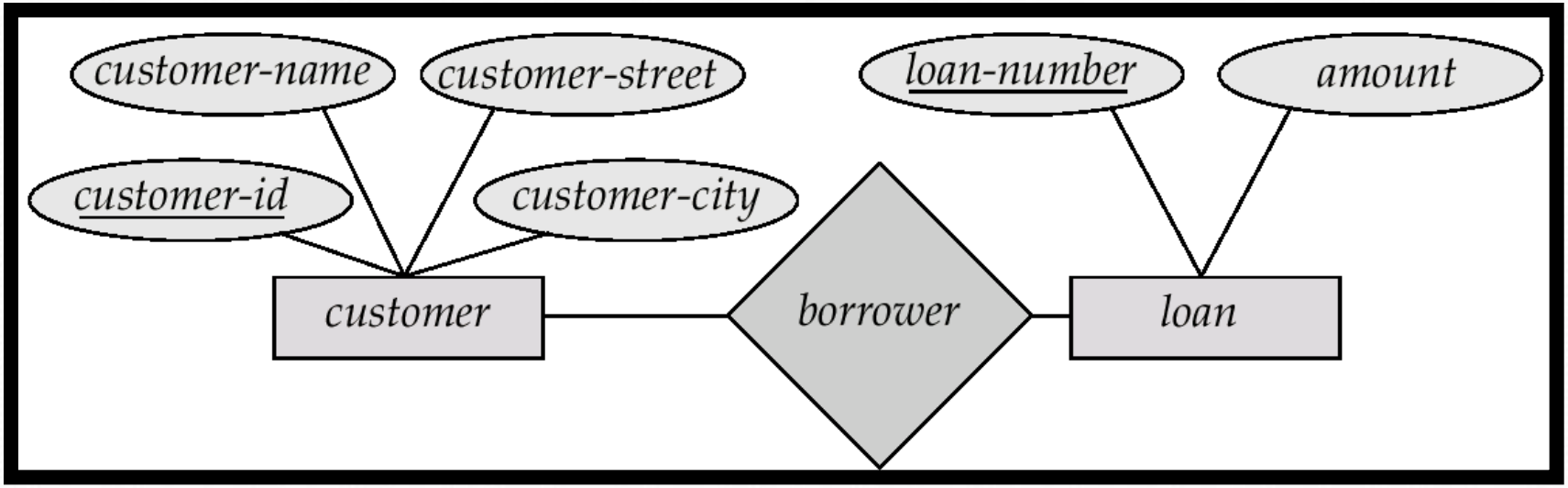


E-R Model Contd…

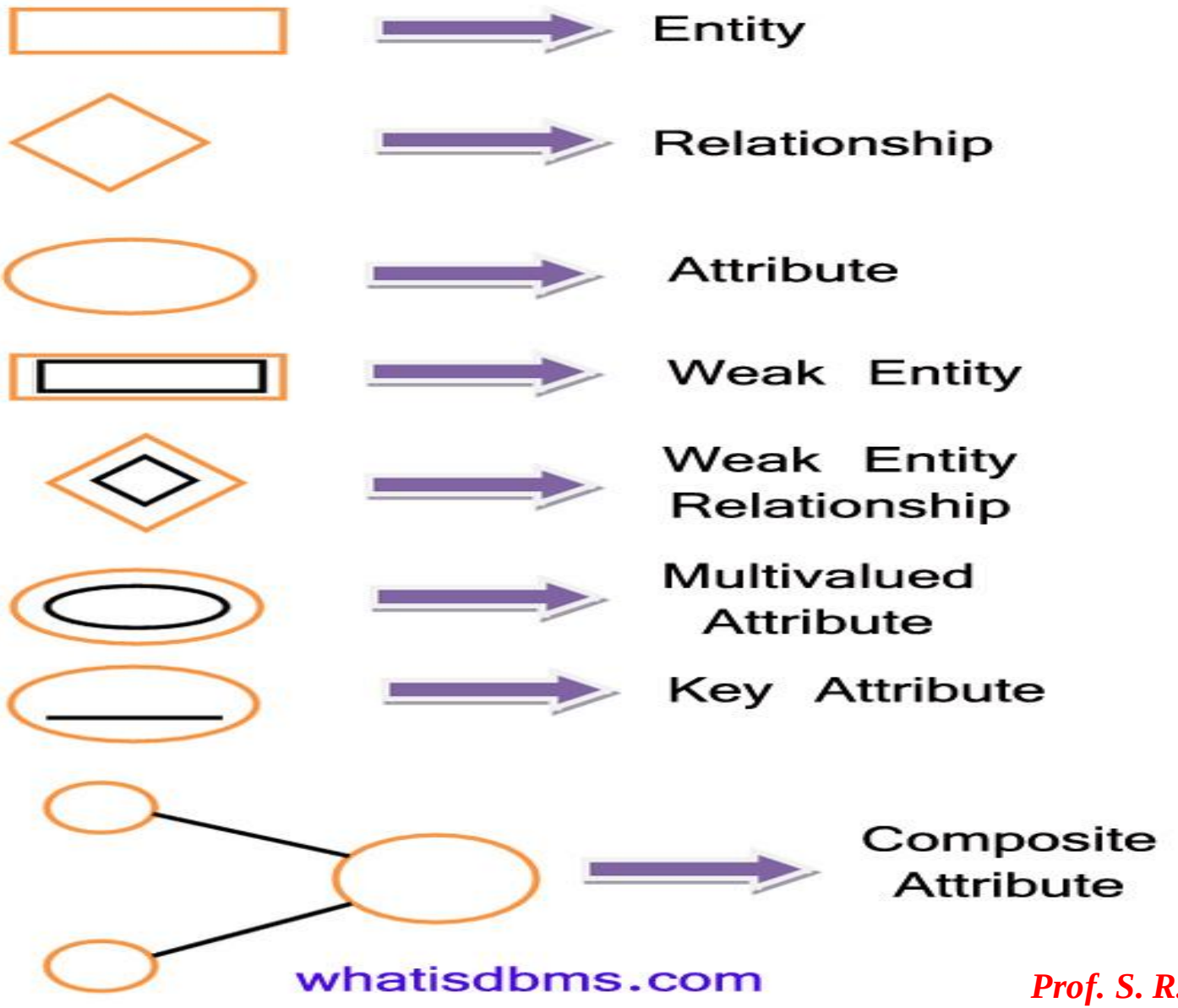
- **Cardinality Constraints**

➢ A customer is associated with several (possibly 0) loans via borrower

➢ A loan is associated with several (possibly 0) customers via borrower



E-R Model Contd…



E-R Model Contd…